Introduction:

The Hydrogen Production Unit (HPU – Unit305) is designed to produce 12837.6 Nm3/h of hydrogen (expressed as pure hydrogen) with a minimum purity of 99.9 vol%. The hydrogen production unit uses Natural Gas and Heavy Naphtha Arabian Light as feedstocks according to the following cases at 100% plant capacity:

Operating feed cases:

Operate feed Case 1 100% Natural Gas feedstock

Operate feed Case 2 100% Heavy Naphtha Arabian Light feedstock

Operate feed Case 3 Natural gas mixed with Heavy naphtha Arabian Light in any relative proportions provided that each feedstock is above the minimum capacity 30%.

Feed Flowrate:

SN	Feed Item	Case 1	Case 2	Case 3	Notes
1	Natural Gas	4997.3 Nm^3/h	0	2454.2 Nm^3/h	
2	Light Arabian Naphtha	0	4022 kg/h	2044 kg/h	

Feed Specification:

(1) Natrual Gas Specification 天然气

Temperature/℃	26~45
Pressure/MPaG	0.21
Natural Gas composition	
COMPONENT	Mole %
C_1	84.1334
C_2	1.9900
C_3	0.4451
iC_4	0.1036
nC_4	0.2804
iC_5	0.0239
nC_5	0.0255
C_6	0.0704
C_{6+}	0.1407
C_7	0.0704
CO_2	1.6552
N_2	11.0581
$NEOC_5$	0.0033
Sulfur	Max 10 ppm-vol (1)

(2) Heavy Naphtha Arabian Light Specification 石脑油

Heavy Naphtha (Arabian Light)	
Temperature/℃	36
Pressure/MPaG	0.35
Sp.Gravity	0.7529
Color	30
R.V.P. @ 38°C,psi	0.5
Sulphur, **ppm**	**410**
Components of PONA	Composition (Vol%)
P	60.9
O	0.4
N	22.5
A	16.2
Total	100

Distillation ASTM D86		
Arabian Light		
Distillation	Standards, °C	
IBP	100 -105	
10%	114-118	
20%	119-120	
30%	120-124	
40%	125-126	
50%	126-128	
60%	129-133	
70%	134-137	
80%	138-140	
90%	140-144	
FBP	160 -170	

PRODUCT SPECIFICATION

Quality		Note
Hydrogen	99.9 % v min	
CO	< 1 ppmv	1
CO + CO_2	< 10 ppmv	1
Conditions		
Flowrate (as pure H_2)	12837.6 Nm^3/h	
Pressure normal/maximum at B.L.	2.07/2.41 MPaG	2
Temperature at B.L.	45 °C	2

PRE-REFORMER REACTOR DETAIL:

305-R03A/B	Prereformers	φ1000xH4527mm； H0：~10250mm
		Operation Pres. ： 3.28MPa(G)
		Operation Temp. ： bottom：508℃/ top：462℃
		Design Pres. ： 4.0MPa(G)
		Design Temp. ： 544℃
		Catalyst Volume：3.03m^3
		Insulation：HC

CATALYST DETAILS:

CATALYST NAME	Item No.	Operating	Type	Composition	Hight of Bed mm	Density kg/m^3	Quantity m^3 (Note 5)
CATALYST	305-R03A	3.28Mpa(G)	NiO		3891		3.03
		top:462℃					
		bottom:508℃					

NO.	Support	Item No.	Operating	Type	Ball's Diameter	Hight of Balls mm	Equipment Diameter	Quantity m^3 (Note 1/2)	Remark
Support Balls Summary List is as below:									
4	Balls	305-R03A	3.28Mpa(G)	Alumina	1"	153	1000	0.12	Note 3
			top:462℃	Alumina	0.24"	102	1000	0.08	Note 3
			bottom:508℃	Alumina	0.5"	102	1000	0.08	Note 3
				Alumina	0.75"	102	1000	0.08	Note 3
				Alumina	0.75"	250	1000	0.13	Note 3

Case 1: Pre-reformer inlet mass flow = 12530 kg/hr

Case 2: Pre-reformer inlet mass flow = 14165 kg/hr

Case 3: Pre-reformer inlet mass flow = 13331 kg/hr

Note: The above mentioned Flow is mixture of hydrocarbon and steam

Bed in / out Temp: To be specified by vendor for all three cases

Bed in / out pressure: To be specified by vendor for all three cases

Bed Life: Minimum 2 years guaranteed, to be specified by vendor for all three cases

Bed pressure drop: < 15 psi guaranteed

The termination of catalyst life is defined as the continuous passage of ethane or heavier components through the catalyst bed at a level greater than 0.2 vol% of the wet gas leaving the pre-reformer when operating at the maximum permitted preheat temperature.